§8. Generation of Elliptic Gaussian Beam by Parallel Corrugated Plates

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A generator of elliptic gaussian beam which consists of circular corrugated (CC) waveguide connected to the parallel corrugated (PC) plates is fabricated. For simplicity, CC-waveguide in stead of square corrugated waveguide is used in the generator.

The HE_{11} mode with the frequency of $\omega/2\pi = 84.05$ GHz excited in 88.9 mm circular corrugated waveguide is injected into the circular polarizer. The output waveguide of polarizer is CC-waveguide with the diameter of 88.9mm. The PC-plate system is jointed to the output of polarizer. The PC-plates with the width of $a = 116$ mm and the length of $z = 1$ m are placed in parallel with the distance of $b = 82.1$mm. The field pattern in the output of PC-plate system is measured by means of the WR-12 waveguide antenna. When an electric field in WR-12 waveguide is in parallel to y-direction, $P_{eyhx} = -\eta_{eff}\Re(E_y \times H_x^*)\Delta S$ is picked up. Here, η_{eff} is antenna gain factor and ΔS the effective area of antenna. When WR-12 waveguide is rotated by 90 degrees around the axis, $P_{exhy} = \eta_{eff}\Re(E_x \times H_y^*)\Delta S$ is detected. Fig. 1(a) shows the results from measurement of P_{eyhx} at the waveguide mouth when the input $\vec{E}$ from the polarizer is adjusted so as to be in perpendicular to the PC-plates.

To excite the cross-polarized mode, an angle of polarization is increased by 90 degrees. In Fig. 1(b) the measured field pattern of P_{exhy} at the waveguide mouth is shown. . Radiation patterns at the output mouse of the parallel corrugated plate with $z = 1$ m injected by HE_{11} mode from the CC-waveguide (88.9×88.9mm^2) are calculated. Calculated output pattern of E_y is shown by using the method of Fourier transformation [1] when HE_{11} mode in the CC-waveguide is injected into the PC-plates with 1m in length. The output pattern obtained is elliptic Gaussian beam. While the polarization of input HE_{11} mode in CC-waveguide is rotated by 90 degrees, the elliptic Gaussian profile is also obtained as same as in Fig. 2. It should be noted that both measured field patterns show elliptic contours in the PC-plate system as shown in the calculated patterns of Fig. 2. From abovementioned results, direct connection of PC-plates to the CC-waveguide is a candidate to obtain the elliptic Gaussian beam.

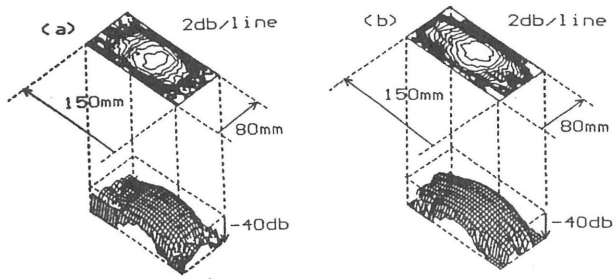

Fig.1:(a) Experimental P_{eyhx} profile in front of parallel corrugated plates with 1m in length.
(b) Experimental P_{exhy} profile in front of parallel corrugatedΛ plates with 1m in length when the cross-polarized mode is excited.

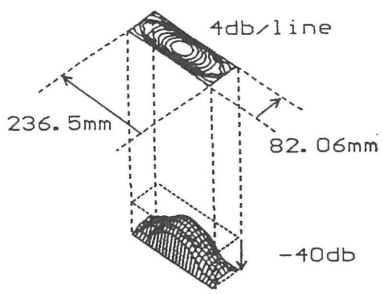

Fig.2: Calculated profile of $E_y(H_x)$ at the output of parallel corrugated plates with 1m in length when co-polarization HE_{11} mode is injected.

References

1)K. Ohkubo, S. Kubo, M. Sato, H. Idei, Y. Takita and T. Kuroda: 5th Int. Toki Conf. To be published in *J. Fusion Engineering and Design*